

Euclidean distance

- Usual form

$$d\ell^2 = dx^2 + dy^2$$

- Matrix form

$$d\ell^2 = \begin{pmatrix} dx & dy \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} dx \\ dy \end{pmatrix}$$

- Concise form

$$d\vec{r} = \begin{pmatrix} dx \\ dy \end{pmatrix}$$

$$g_{\mu\nu} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$d\ell^2 = d\vec{r}^T g_{\mu\nu} d\vec{r}$$

Distance in polar coordinates

- Usual form

$$d\ell^2 = dr^2 + r^2 d\theta^2$$